REMARKS

The Amendment After Final Rejection submitted December 18, 2006, in the above-identified application, is noted. This Amendment After Final Rejection was refused entry in the Advisory Action mailed January 24, 2007, in the above-identified application. Noting the concurrent filing of a Request for Continued Examination (RCE) Transmittal, it is respectfully requested that the Amendment After Final Rejection submitted December 18, 2006, not be entered in the above-identified application; and it is respectfully submitted that the present Submission constitutes the sole Submission supporting the concurrently filed RCE Transmittal.

The Examiner is thanked for the telephone interview courteously granted to the undersigned, in connection with the above-identified application. During this telephone interview, the various rejections of the claims, set forth in the Office Action mailed September 18, 2006, were discussed, and various claim amendments were discussed, the undersigned pointing out how these amended claims avoided the rejections in the Office Action mailed September 18, 2006. No agreement was reached during this interview.

Applicants are amending their claims in order to further clarify the definition of various aspects of the present invention. Noting that claims 24 and 25 are not entered, since the Amendment After Final Rejection filed December 18, 2006, is not entered, Applicants are adding new claims 26-31 to the application; are canceling claim 14; and are amending various of the previously considered claims in light of newly added claim 26. Claims 26 and 27 correspond respectively to claims 24 and 25 (unentered) in the Amendment After Final Rejection filed December 18, 2006.

Specifically, claim 26 defines a sheet chemical cell including an electrolyte membrane having slots, a plurality of anode plates for oxidizing fuel, formed on one

face of the membrane, and a plurality of cathode plates for reducing oxygen, formed on the other face of the membrane. Claim 26 further recites that each of the plurality of cathode plates constitutes a pair with a respective anode plate of the plurality of anode plates. Claim 26 also recites a plurality of first electrically conductive current-collecting plates covering all of the plurality of anodes, and a plurality of second electrically conductive current-collecting plates covering all of the plurality of cathodes, and further recites that the first electrically conductive current-collecting plates and the second electrically conductive current-collecting plates are electrically connected with each other through respective slots, of the slots of the electrolyte membrane. Thus claim 26, as compared with claim 14, recites language consistent with terms in the specification of the above-identified application (for example, reciting electrically conductive current-collecting plates, as in, for example, page 17, lines 5-14, of Applicants' specification). In light of new claim 26, claim 16 (in addition to claim 14) has been cancelled without prejudice or disclaimer; and various of the claims previously dependent on claim 14, have been made dependent on claim 26. In addition, claim 19 has been cancelled without prejudice or disclaimer. Moreover, each of claims 4 and 5 has been amended to recite the "plurality of" anodes and cathodes; claim 18 has been amended to recite "electrically conductive current-collecting plates"; and claim 20 has been amended to recite that "all of the" slots are positioned between adjacent anodes and between adjacent cathodes (see, e.g., Fig. 3 of Applicants' original disclosure).

In addition to claim 26, Applicants are adding new claims 27-31 to the application. Claim 27, dependent on claim 26, recites that each of the plurality of anodes has one first electrically conductive current-collecting plate, of the plurality of first electrically conductive current-collecting plates, covering thereon; and that each

of the plurality of cathodes has one second electrically conductive current-collecting plate, of the plurality of second electrically conductive current-collecting plates, covering thereon. Note, for example, page 17, lines 5-8 and 17-19, of Applicants' specification. Claims 28 and 29, dependent respectively on claims 26 and 28, respectively recites that the electrolyte membrane is a single electrolyte membrane having the slots, and recites that the single electrolyte membrane has a plurality of slots. Claims 30 and 31, dependent respectively on claims 29 and 26, recite that the electrolyte membrane is a continuous membrane. Note, for example, electrolyte membrane 1 in Fig. 3 of Applicants' specification, and, for example, the description in connection therewith, for example, on page 16, lines 6-14, of Applicants' specification.

Noting the concurrent filing of a RCE Transmittal in the above-identified application, and that the present amendments constitute the necessary Submission under 37 CFR 1.114 supporting this RCE Transmittal, entry of the present amendments is clearly proper, notwithstanding Finality of the Office Action mailed September 18, 2006.

Applicants respectfully traverse the rejection of claims 22 and 23 under the first paragraph of 35 USC 112, as failing to comply with the written description requirement, set forth in Item 6 on page 3 of the Office Action mailed September 18, 2006. As will be shown in the following, it is respectfully submitted that Applicants' original specification demonstrates that, as of the filing date of the above-identified application, Applicants contemplated as part of their invention the subject matter of claims 22 and 23, and thus the rejection of these claims as failing to satisfy the description requirement of the first paragraph of 35 USC 112, is improper.

Thus, attention is respectfully directed to page 16, lines 21-24 of Applicants' specification, which states that:

> "In this case, Three slots between three upper right unit cells and three lower right unit cells are not used for electrical connection and filled with resin."

Note also a disclosed purpose of the slots, other than for electrical connection, set forth on page 16, lines 12-14, as follows:

> "These slots also work to prevent short-circuiting of adjoining two electrodes by ions."

Note also the disclosure on page 13, lines 15-18, of Applicants' specification, that the examples disclose several preferred embodiments to illustrate the invention, but that "it is to be understood that the invention is not intended to be limited to the specific embodiments".

Taking Applicants' original disclosure as a whole, including especially the portions thereof referred to in the foregoing, it is respectfully submitted that Applicants' original disclosure establishes that Applicants contemplated as part of their invention, a cell wherein not every slot is used for electrical connection, as in claims 22 and 23.

During the aforementioned Interview, the Examiner noted that page 16, lines 21-24, described "three slots" not being used for electrical connection, and questioned whether this supported the subject matter of claims 22 and 23 that "not every slot" is used for electrical connection. As can be appreciated, recitations in the claims need not be described in haec verba in the specification; the requirement under the description requirement of 35 USC 112, first paragraph, is whether Applicants' disclosure as a whole shows that Applicants contemplated as part of their invention the claimed subject matter. See In re Smythe, 178 USPQ 279 (CCPA

1973). Noting especially the described embodiment, and a function of the slots, which function would be appropriate in connection with one or more slot, as well as the clear description in Applicants' original disclosure that the invention is not to be limited to the specific embodiments, it is respectfully submitted that Applicants have established that they contemplated as part of their original invention structure wherein not every slot is used for electrical connection. Accordingly, reconsideration and withdrawal of the rejection under the first paragraph of 35 USC 112 is respectfully requested.

Applicants respectfully traverse the rejection of all of their claims under the second paragraph of 35 USC 112, as being indefinite, as set forth in Items 8-10 on pages 3 and 4 of the Office Action mailed September 18, 2006.

Thus, claim 19 has been cancelled without prejudice or disclaimer. Accordingly, basis for rejection of claim 19 under the second paragraph of 35 USC 112 is moot. Claim 26 as submitted, and claim 20 as presently amended, consistently use the language "plurality of anode plates" and "plurality of cathode plates", claim 26 reciting that each of the plurality of cathode plates constitutes a pair "with a respective anode plate of the plurality of anode plates". In view of claim 26, as well as amendment of claim 20 to recite "all of the slots", it is respectfully submitted that the present claims are clear with respect to the cathode plates and anode plates and slots (e.g., all of the anodes and/or cathodes and/or slots) being recited in the claims. It is respectfully submitted that all of the claims being considered on the merits in the above-identified application sufficiently define the metes and bounds of the present invention, such that one of ordinary skill in the art would know whether any specific sheet chemical cell fell within or outside the scope

of the present claims. Under the present circumstances, the second paragraph of 35 USC 112 requires nothing more. See In re Moore, 169 USPQ 236 (CCPA 1971).

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed September 18, 2006, that is, the teachings of the U.S. patent documents to Kidai, et al., No. US2005/0074651, to Choi, No. 6,689,502, and to Lawrence et al., No. US2004/0013927, under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a sheet chemical cell as in the present claims, including, inter alia, wherein the cell has an electrolyte membrane having slots, wherein the cell includes a plurality of first electrically conductive current-collecting plates covering all of the anodes and a plurality of second electrically conductive current-collecting plates covering all of the plurality of cathodes, and wherein the first electrically conductive current-collecting plates and the second electrically conductive current-collecting plates are electrically connected with each other through respective slots, of the slots of the electrolyte membrane. See claim 26.

Furthermore, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such sheet chemical cell as in the present claims, having features of claim 26 as discussed previously, and, furthermore, wherein the electrolyte membrane is a single electrolyte membrane having the slots (see claim 28), particularly wherein the single electrolyte membrane has a plurality of slots (see claim 29); and/or wherein the single electrolyte membrane is a continuous membrane (see claims 30 and 31).

In addition, it is respectfully submitted that these references would have neither taught nor would have suggested such sheet chemical cell as in the present claims, having features as discussed previously in connection with claim 26, and, additionally, wherein each of the plurality of anodes has a respective first electrically conductive current-collecting plate, of the plurality of first electrically conductive current-collecting plates, covering thereon, and each of the plurality of cathodes has a respective second electrically conductive current-collecting plate, of the plurality of second electrically conductive current-collecting plates, covering thereon (see claim 27); and/or wherein the slots (of the electrolyte membrane) are filled with an insulating resin (see claim 15); and/or wherein all of the slots are positioned between adjacent anodes and between adjacent cathodes (see claim 20), or wherein a slot, of the slots of the electrolyte membrane, is independently provided between every two adjoining anodes and between every two adjoining cathodes (see claim 21); and/or wherein not every slot is used for electrical connection (see claims 22 and 23); and/or wherein the cell further includes a plastic sheet as a cover of the sheet chemical cell (see claim 17), with the first and second electrically conductive current-collecting plates and the plastic sheet being provided with through-holes through which fuel and oxygen are supplied (see claim 18); and/or wherein the anodes and cathodes are porous membranes prepared by a slurry containing specified components as in claim 4, with catalysts of the anodes and catalysts of the cathodes as in claim 5.

The present invention relates to a sheet chemical cell, particularly useful, for example, in fuel cells such as a direct methanol fuel cell (DMFC) using methanol and water as fuel, or a polymer electrolyte fuel cell (PEFC).

There have been attempts to develop smaller power generators that need no recharging, e.g., as power sources for recent electronic devices such as mobile telephone sets, book-type personal computers, audiovisual equipment and mobile information terminal equipment. As one of such power generators meeting requirements of small size, and a power supply of higher energy density and of longer running periods (in particular, that need no recharging), a fuel cell power supply has been discussed.

Types of fuel cells being proposed for power supplies for electronic devices discussed in the foregoing include polymer electrolyte fuel cells and direct methanol fuel cells. Direct methanol fuel cells show promise as oxygen is supplied to the outer surfaces of a cathode, in contact with outside air, so that this type of power generation device does not require any auxiliary machine to supply the fuel and the oxidizing agent, simplifying the fuel cell system. However, each individual cell of the direct methanol fuel cell has a very low output voltage, e.g., 0.3-0.4V; therefore, to generate an output voltage to power portable electronic devices, the unit cells must be connected in series. As described in the last paragraph on page 5 of Applicants' specification, these unit cells are serially connected in the anode-to-cathode manner to generate a voltage for powering the portable electronic equipment.

However, previously proposed fuel cells having such series connection are very complicated to manufacture, and the manufacturing method is time-consuming, because the unit cells must be electrically connected in series. As can be appreciated, as the number of units cells to be connected increases, the problem becomes more severe. Furthermore, each unit cell must be sealed to prevent leaks, which limits the energy density of the cell.

Against this background, Applicants provide a sheet chemical cell which is simple and easy to fabricate, providing unit cells which can be connected in series so as to achieve sufficient output voltage, and in which undesirable ion flow between adjoining two electrodes (e.g., adjoining cathodes, or adjoining anodes) is avoided. Moreover, the cells according to the present invention can have a relatively small thickness. Applicants have found that by providing the electrolyte membrane with slots, e.g., as a single, continuous membrane having a plurality of slots, and with electrically conductive first and second current-collecting plates being formed on all of the anodes and cathodes, and being connected with each other through these slots formed in the electrolyte membrane, the structure can be manufactured by simple and efficient processing steps, providing a structure which has a relatively small thickness.

By sealing these slots with an insulating material, leakage through the membrane can be avoided.

In addition, by providing the slots, in particular between adjacent anodes and cathodes (in claim 21, between every two adjoining anodes, and between every two adjoining cathodes) short circuiting between adjacent electrodes due to ion flow therebetween can be avoided. See, e.g., page 16, lines 12-14, of Applicants' specification.

As described in the first two paragraphs on page 8 of Applicants' specification, the unit cells are electrically connected in series, in parallel or both in series and parallel to output desired high voltages and currents, and fuel cells utilizing the sheet chemical cells of the present invention can run portable electronic equipment as referred to on page 8 of Applicants' specification. As for advantages achieved by the

present invention, note, for example, the sole full paragraph on page 22, and the paragraph bridging pages 22 and 23, of Applicants' specification.

Kidai, et al. discloses a polymer electrolyte membrane and a polymer electrolyte fuel cell using such membrane. The membrane is filled with a proton conductor in the collimated pores of a polymer film equipped with a plurality of these collimated pores in the vertical direction, and is characterized with a relative standard deviation (LVar/LAve) equal to or below 0.3, wherein LAve and LVar represent an average value of L distances between centers of the adjacent collimated pores and the standard deviation thereof, respectively. Note especially paragraph [0015] on page 2 of this patent publication. Note also paragraphs [0056], [0058], [0059], and [0061] on page 5 of this patent publication. Note also paragraph [0064] bridging pages 5 and 6 of this patent publication. See also paragraphs [0085] and [0086] on page 8 of this patent publication.

The Examiner has relied on Fig. 6 of this patent publication, especially the lowermost figure of Fig. 6. Fig. 6 is described, e.g., in paragraph [0054] on page 4, and paragraph [0141] on page 11, of this patent publication. Shown in the lower-most figure of Fig. 6 are reference characters 7, which constitute electrodes of the cell.

It is respectfully emphasized that Kidai, et al. depicts a polymer electrolyte membrane comprising a plurality of electrodes 7 consisting of respective electrode substrate and electrocatalyst layers. Note paragraph [0058] on page 5 of this patent publication. The electric connection between the anodes and cathodes located on opposite sides of the membrane is formed by electron conducting area 5. Note paragraphs [0056] through [0058] of this patent publication.

In Kidai, et al., it is respectfully submitted that the electrodes 7 are shown exposed, and are not covered with current-collecting plates, as in the present claims.

Moreover, it is respectfully submitted that Kidai, et al. does not disclose, nor would have suggested, slots in the electrolyte membrane, much less the combination of slots and current-collecting plates, providing advantages in simplicity of manufacture and effectiveness of the cell of the present invention, as discussed previously.

Contentions by the Examiner in the first full paragraph on page 5 of the Office Action mailed September 18, 2006, are respectfully traversed. It is respectfully submitted that the pores in the membrane in Kidai, et al., do not disclose, nor would have suggested, slots as in the present claims. It is respectfully submitted that it is an unreasonable interpretation of the disclosure of Kidai, et al., to interpret the pores in Kidai, et al. as slots.

Furthermore, it is emphasized that present claim 26, as well as previously considered claim 16, recite electrical connection between the first and second electrically conductive current-collecting plates through the slots. Such structure would have neither been disclosed nor would have been suggested by the teachings of Kidai, et al., even considering the porous area as "slots", as Kidai, et al. only describes electron conduction.

In addition, the further contention by the Examiner in the sole full paragraph on page 5 of the Office Action mailed September 18, 2006, that the separators in Kidai, et al. serve as the plurality of wiring plates covering respective cathodes and anodes, is respectfully traversed. If the separator were electrically conductive and covered the anode and cathode in Kidai, et al., they would be electrically short-circuited, so that a fuel cell would not be formed. Clearly, the interpretation by the

Examiner of the teachings of Kidai, et al., including the interpretation by the Examiner that the separator in Kidai, et al. serves as current-collecting plates covering the anodes and cathodes, constitutes an unreasonable interpretation of the teachings of Kidai, et al.

Choi discloses a cell pack of a direct methanol fuel cell, having structure described most generally in the paragraph bridging columns 2 and 3 of this patent. This patent discloses that the cell includes upper and lower plates spaced a predetermined distance apart from each other, with an ion exchange membrane provided therebetween, a plurality of first anodes installed in each single cell region on the first surface of the membrane and a plurality of first cathodes disposed in each single cell region adjacent to each of the anodes, a plurality of second cathodes installed in each single cell region on a second surface of the ion exchange membrane corresponding to the first anodes, and a plurality of second anodes corresponding to the first cathodes, first and second anodes current collectors installed on the first and second anodes and each having a fuel passage region, first and second cathode current collectors installed on the first and second cathodes, with a plurality of first conductive portions electrically connecting the first anode and cathode adjacent to each other on the first surface of the ion exchange membrane and a plurality of second conductive portions electrically connecting the second anode and cathode adjacent to each other on the second surface of the ion exchange membrane to electrically connect in series cells provided in the single cell region. Note also, for example, column 5, lines 29-34 of Choi.

As a background to Choi, and as pointed out by the Examiner during the Interview, this patent discloses in Fig. 3 a conventional monopolar cell pack having some parts of single cells being disposed in a row so as to overlap with neighboring

cells, cathodes 13 and 13a of the respective cells being electrically connected in series to an anode 12a of a cell next thereto by current collectors 14 and 14a. Between the anode 12, 12a, etc. and the cathode 13, 13a, etc. of respective unit cells are structure 11, 11a, 11b, etc. (which appears not to be described in Choi and would appear to be overlapping individual membranes). In connection with Fig. 3, note column 2, lines 39-52 of Choi.

It is respectfully submitted that Choi in Fig. 3 has individual membranes 11, 11a, 11b, etc., with current collectors passing between the individual membranes, which overlap each other. It is respectfully submitted that this structure as in Fig. 3 of Choi would have neither disclosed nor would have suggested, and in fact would have taught away from, the presently claimed structure, including an electrolyte membrane having slots, a single or continuous electrolyte membrane having the slots (in particular, a plurality of the slots), or the combination of the slots and the plurality of first electrically conductive current-collecting plates covering all of the plurality of anodes and the plurality of second electrically conductive current-collecting plates covering all of the plurality of cathodes, and advantages thereof as in the present invention.

The contention by the Examiner on page 9 of the Office Action mailed September 18, 2006, that "it can be reasonably concluded that the slots are formed around the cathodes/anodes of the 2nd cell and positioned between adjacent anodes/cathodes; a slot is independently provided between every two adjoining anodes/cathodes (one slot between 1st cell and 3rd cell)", is respectively traversed. As can be appreciated in Fig. 3 of Choi, individual membranes overlap, and the current collectors pass through openings between individual membranes. It is respectfully submitted that this structure as in Fig. 3 of Choi is complex, requiring a

plurality of membrane members which, for example, must be provided in desired positions. It is respectfully submitted that this structure as in Fig. 3 of Choi would have neither disclosed nor would have suggested the relatively simple structure, and relatively simple processing to provide such structure, of the membrane (in particular, the single or continuous membrane) with slots, with the respective current-collecting plates covering all of the plurality of anodes and all of the plurality of cathodes, and with the current-collecting plates being electrically connected with each other through the slots.

It is respectfully submitted that the additional teachings of Lawrence would not have rectified the deficiencies of the teachings of either of Kidai, et al. and of Choi, such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Lawrence, et al. discloses a fuel cell assembly for portable electronic devices. The assembly includes a membrane electrode assembly, a removable fuel cartridge, and a fuel delivery system. The removable fuel cartridge includes an expandable fuel bladder for receiving liquid fuel, an expandable pressure member in contact with the bladder for maintaining a positive pressure on the bladder, and a sealable exit port in fluid communication with the bladder. Note paragraph [0013] on page 1 of this publication. This patent document discloses, in paragraph [0087] on page 6, that the expandable fuel bladder is formed of a sheet plastic material and/or other polymeric materials which are substantially impervious to methanol.

Even assuming, arguendo, that the teachings of Lawrence, et al. were properly combinable with the teachings of Kidai, et al. or Choi, such combined teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including combination of first and second electrically

conductive current-collecting plates, positioned relative to the anodes and cathodes and/or the membrane with slots and positioning thereof, and/or wherein the first and second electrically conductive current-collecting plates are respectively electrically connected through the slots, and advantages thereof, as discussed previously.

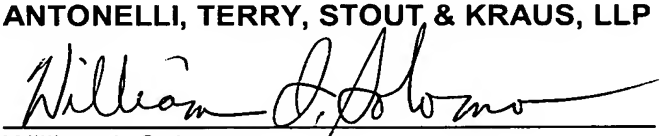
In addition, from a review of Lawrence, et al., it is respectfully submitted that Lawrence, et al. discloses use of sheet plastic material for the expandable fuel bladder. It is respectfully submitted that such disclosure, even in combination with the teachings of Kidai, et al. or Choi, would have neither disclosed nor would have suggested such cell including a plastic sheet as a cover of the sheet chemical cell, as in claim 17, or wherein the plastic sheet, as well as the first and second electrically conductive current-collecting plates, are provided with through-holes through which fuel and oxygen are supplied.

In view of the foregoing comments and amendments, and in view of the concurrently filed RCE Transmittal, entry of the present amendments, and reconsideration and allowance of all claims presently in the application, are respectfully requested.

Applicants request any shortage in fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case 520.43227X00), and credit any excess payment of fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



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